Arterialized collateral capillaries progress from nonreactive to capable of increasing perfusion in an ischemic arteriolar tree.

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Public Summary:
Natural bypass arteries, i.e. collaterals, can improve the prognosis in patients with occlusive artery disease. Unfortunately, some patients never develop identifiable collaterals. However in animal models, collaterals can form from capillaries, and may represent a therapeutic target for patients who lack traditional collaterals. However, for these collateral capillaries to function, they must be capable of increasing blood flow to the region downstream of the occluded artery. Therefore, we evaluated the ability of capillary collaterals to increase their diameter and control blood flow. We found that one week after artery occlusion, capillary collaterals were unable to increase their diameter or increase blood flow. However, by three weeks after artery occlusions, collateral capillaries could increase their diameter and increase blood flow to the zone downstream of the artery occlusion. Future studies will investigate strategies for accelerating time course over capillary collaterals develop proper function.

Scientific Abstract:
OBJECTIVE: CCA, outward remodeling of capillaries that anastomose 2 arteriolar trees with different parent feed arteries, may represent a therapeutic target for patients who lack collaterals. ACCs can reperfuse an ischemic tree, but their functional capacity is unknown. Therefore, we determined whether ACCs mature into resistance vessels that regulate blood flow following arterial occlusion. METHODS: We ligated the lateral spinotrapezius feed artery in Balb/C mice, which induces CCA. At days 7 and 21 following occlusion, we measured vasodilation of ACCs using intravital microscopy and blood flow in the ischemic tree using LSF. We determined the presence of ACCs and neurovascular alignment with immunofluorescence. RESULTS: At day 7, ACCs do not vasodilate following muscle contraction and have reduced responses to endothelial- and smooth muscle-dependent agents. By day 21, ACCs exhibit normal vasodilation, accompanied by normalized increases in relative blood flow to the ischemic zone. Although functioning as resistance vessels by regulating blood flow, ACCs do not appear to be innervated. CONCLUSIONS: ACCs mature into resistance vessels that regulate blood flow to the downstream tissue. Therefore, induction of mature ACCs may be a target for reducing ischemia in patients who lack collateral networks.